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News Bulletin of The Entomological Society of Victoria Inc.

THE ENTOMOLOGICAL SOCIETY OF VICTORIA (Inc)

MEMBERSHIP

Any person with an interest in entomology shall be eligible for Ordinary membership. Members of the Society include professional, amateur and student entomologists, all of whom receive the Society's News Bulletin, the Victorian Entomologist.

OBJECTIVES

The aims of the Society are:

(a) to stimulate the scientific study and discussion of all aspects of entomology,
(b) to gather, disseminate and record knowledge of all identifiable Australian insect species,
(c) to compile a comprehensive list of all Victorian insect species,
(d) to bring together in a congenial but scientific atmosphere all persons interested in entomology.

MEETINGS

The Society's meetings are held at the 'Discovery Centre', Lower Ground Floor, Museum Victoria, Carlton Gardens, Melway reference Map 43 K5 at 8 p.m. on the third Tuesday of even months, with the exception of the December meeting which is held on the second Tuesday. Lectures by guest speakers or members are a feature of many meetings at which there is ample opportunity for informal discussion between members with similar interests. Forums are also conducted by members on their own particular interest so that others may participate in discussions.

SUBSCRIPTIONS

Ordinary Member	$30 (overseas members $32)
Country Member	$26 (Over 100 km from GPO Melbourne)
Student Member	$18
Electronic (only)	$20
Associate Member	$ 7 (No News Bulletin)
Institution	$35 (overseas Institutions $40)

Associate Members, resident at the same address as, and being immediate relatives of an ordinary Member, do not automatically receive the Society's publications but in all other respects rank as ordinary Members.

LIFE MEMBERS: P. Carwardine, Dr. R. Field, D. Holmes, Dr. T. New, Dr. K. Walker, Daniel Dobrosak.

Cover design by Alan Hyman.

Cover photo *Euops* probable *falcata* This photo was taken at Golden Valley Lodge, Flinders on the Mornington Peninsula on 26th Mar 2011 by Joshua Grubb For the story of this taxon see Rolf Oberprieler's notes on page 1VE 42(1) February 2012.

Figure 1. Photo from Tiziano Barberi's presentation on macro photography. He merged 3 images using the auto-align and auto-blend layers options in Photoshop CS4. Likely from Noctuid family.

Minutes of the General Meeting Tuesday, 16 October 2012 Melbourne Museum

Present: R. Best, J. Grubb, M. Fiedel, L. Rogan, T. Hausler, T. Barberi, M. Hewish, P. Carwardine

Apologies: I. Endersby, K. McBean, C. Page, K. Proudley, E. Collins, D. Stewart, S. Curle, D. Dobrosak, M. Halsey, G. Kuseff, K. Walker, P. Marriott, G. Weeks.

Guests: P. Honan - Melbourne Museum, L. Bickmore - PepperTree: Annual Garden Fiesta
The meeting was opened by Editor, Linda Rogan at 7:55.

Previous minutes: 19th June VE42 (4) p.65 and notes 21 August VE 42(5) p. 85 were approved (Hewish, Best)

Correspondence:

From Melbourne Museum re: survey with Parks Victoria, held at Grampians Dates: 19 - 30 November

EMAIL from Secretary of the Australian Entomological Society seeking our thoughts on the removal of Affiliated Societies from the AustEntSoc constitution.

EMAIL from Gerwin Kasperek : Vifabio, the Virtual Library of Biology – has a new service: the Calendar of Conferences and Congresses. http://www.vifabio.de/?lang=en

SARAH MANSFIELD, Senior Lecturer in Entomology Sydney University: Research Masters project available–contact E sarah.mansfield@sydney.edu.au

Treasurer's Report:

General account $ 6,424; Le Souef Award account $ 5,623; Publishing account $ 16,426
Unfinancial Members 3

Editor's report:

There are sufficient articles in hand for the next bulletin. More short items, observations and relevant photos are welcome. Also submit any photos of Victorian insects with ID and a short note about the photo taken for possible use as a cover photo for the bulletin next year.

New Member:

Welcome to the following new member whose application has been received and approved:
David Mules, Narracan, Victoria: interested in moths and butterflies.

General Business:
Science Talent Search Bursaries have been awarded as follows:

Courtney Dooley. Firbank Grammar School. Junior Poster. Minor Bursary.
"A Sustainable Food System: Compost and Worm Farming."

Kiara Jarvis. Hume Anglican Grammar School. Lower Primary Experimental Research. Minor Bursary. "No More Chemicals, No More Bugs."

Alyson Gilmore. Presbyterian Ladies College. Intermediate Science Photography. Minor Bursary. "Decomposition of Manure by Dung Beetles."

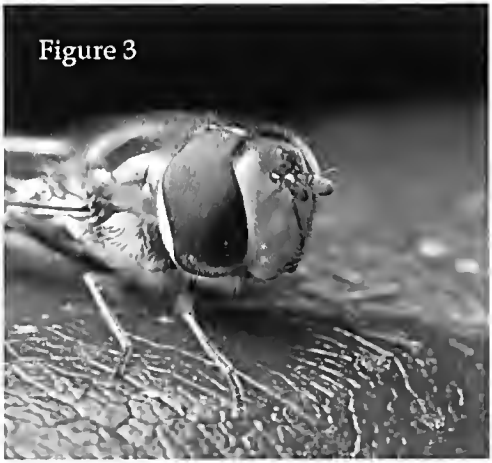
The main item of the evening was members' presentations as well as a presentation by guest Lizzie Bickmore.

Tiziano Barberi - Up close with Ti
Macrophotography (Figures 1, 2, 3)

Ti talked about the know-how of macrophotography with an introduction to the basic rules. He brought his own camera, Canon 5D, to show how he uses it with some adapted equipment for positioning and diffusing light from the flash.

He showed some images from his gallery of Australian and American insects. He stressed that he is a photographer and a scientist with an interest in insects but not an entomologist and therefore hadn't identified the species.

Figure 2 The boatman fly (*Pogonortalis doclea)* and
Figure 3 (p.111)The winter hoverfly (*Episyrphus balteatus*) both from Ti's garden.



His complete setup macro camera with chest supported "tri-pod", offset flash and homemade diffuser weighs about 4kg. Several members took the opportunity for a closer look at this equipment after the meeting.

Lizzie Bickmore - PepperTree: Annual Garden Fiesta. Lizzie works for the community garden and is working towards bringing the garden closer to the community. She is organising the annual fiesta with a "bugs" theme in Coburg on 10th November. She is also seeking volunteers for a project called "habitat planting" to attract insects to the area.

Josh Grubb - 'Caddisfly dispersal: The influence of life history and morphology'
Josh presented an introduction to his honours project on Caddisfly dispersal. He will be conducting this in the Otways in a fairly stable catchment area. His aims are to describe life history traits related to dispersal, to compare traits within and beween species temporally and spatially and to indicate constraints on dispersal such as asynchronous emergence. The taxa are *Tasimia palpata* (Tasimiidae) and *Asmicridea* sp. (Hydropsychidae). We anticipate hearing the results of Joshua's study next year. His supervisor is R. Marchant (Museum Victoria)

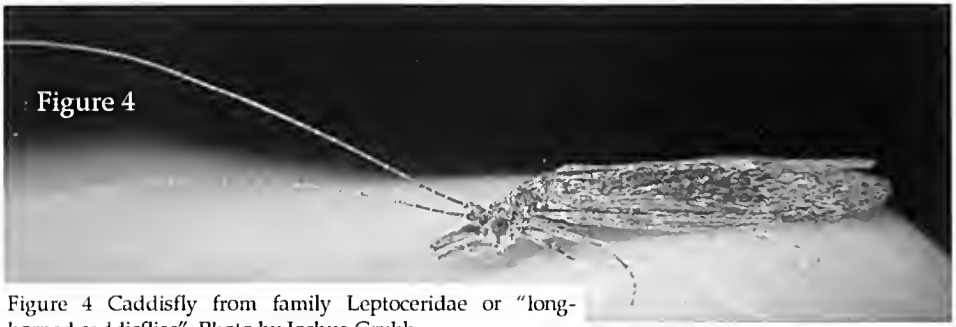
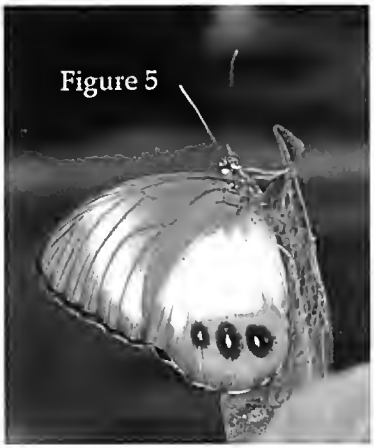


Figure 4 Caddisfly from family Leptoceridae or "long-horned caddisflies". Photo by Joshua Grubb.

Figure 5 *Elymnias agondas ssp. australiana* Palmfly. Photo by Linda Rogan



Linda Rogan - Insects from FN Queensland July/August 2012

Firstly, some butterflies photographed in Iron Range:

Eurema puella the Broad-margined Grass-yellow, larval food plants include *Archidendron hirsutum* (Mimosaceae) and *Ventilago ecorollata* (Rhamnaceae)

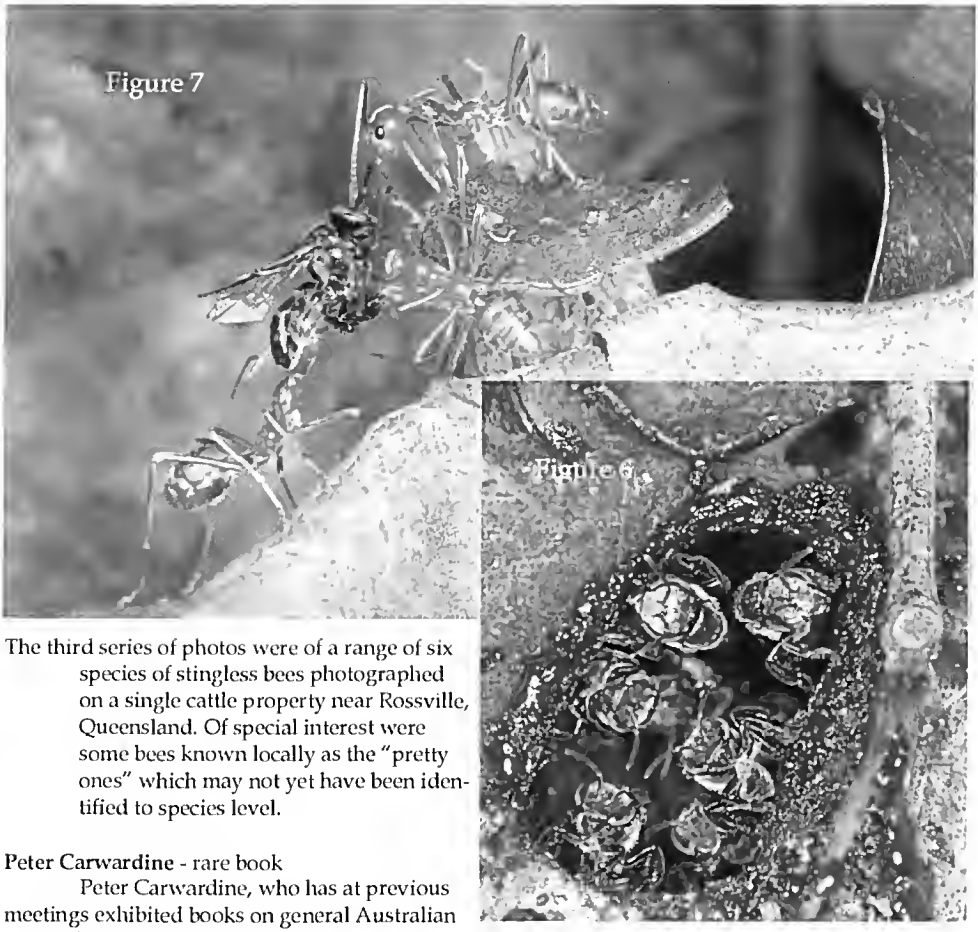
Pantoporia venilia Black-eyed Plane, larval food plant *Lepidopetalum subdichotomum* according to Braby (2004)

Hypocysta angustata Pied Ringlet, larval food plants include Poaceae such as wire grass

Elymnias agondas ssp. australiana Palmfly, larval food plant *Calamus caryotiodes* (Arecaceae) The Fishtail Lawyer Vine.

Secondly a series of photos of *Tetragonula carbonaria* confronting green tree ants *Oecophylla smaragdina* around their hive entry along the path to Endeavour Falls. Linda was excited as it was the first time she had located a wild nest.

Figure 6 *Tetragonula carbonaria* defending their in-ground nest. Below right.
Figure 7 *Oecophylla smaragdina* Green tree ants carrying off a *T carbonaria* carcass. Below.



The third series of photos were of a range of six species of stingless bees photographed on a single cattle property near Rossville, Queensland. Of special interest were some bees known locally as the "pretty ones" which may not yet have been identified to species level.

Peter Carwardine - rare book

Peter Carwardine, who has at previous meetings exhibited books on general Australian entomology, exhibited an early Australian book on Lepidoptera: *Insects of New Holland* by Edward Donovan, London 1805. The book has figures and descriptions of one hundred and fifty three species , the majority being Australian. There are 41 hand coloured plates.

Edward Donovan was born in Cork, Ireland in 1768. He lived in London, apart from occasional excursions in England and Wales, and died there in 1837.
He was a natural history illustrator and amateur zoologist. His *Insects of New Holland* is based on specimens collected on James Cook's voyages. It is the first publication dealing exclusively with the insects of Australia. He was the author of several other natural history books, including others on insects.

The meeting was closed at 9:40.

Notes from council meeting of 20 November 2012
To be confirmed and entered into the minutes at the next council meeting.

Present: P. Marriott, L. Rogan (note taker), P. Carwardine
Apologies: I. Endersby, S. Curle, P. Lillywhite

Previous minutes from 18 September 2012 to be confirmed at next council meeting

Correspondence:

- Anne Molan CSIRO re: inserts in Victorian Entomologist. Such inserts will be included in the bulletins posted from time to time.
- Nick Lane Display officer at Phoenix Park Library re: EntSocVic displaying in their display case. P.M. will consult with P.L. as to how we can get material for this display.

Treasurer's report
Account Balances

General a/c $5,995
Le Souef a/c $5,623
Publishing a/c $16,582
2 Unfinancial Members: Their bulletins will not be sent after the December issue.

Editor's Report
The cover for next year will be from an order different from those of the past 3 years.
There are sufficient long articles in hand for the February bulletin.
Shorter items and observations are still required and encouraged.
Discussion was held on the need for variety within each bulletin. Therefore it was suggested that any articles in excess of 5 solid pages of text be returned to the author for reconsideration.

Membership
No new members for this month.

General business
Next meeting on 4th December will be a combined event at Riddells Creek with Riddells Creek Landcare Group. Linda will continue to liaise with Russell for final details. Marilyn and Dean Hewish and Ken Harris have agreed to set up light sheets. As the December bulletin will not be received prior to 4th December, members will receive invitations with details via email or via post where no email is given.

1. 2013 Schedule

Discussion was held as to possible topics for next year, aiming for information from a range of insect orders. Possible topics include Odonata and Hemiptera "Cicadidae". For dates see table below.

2. Publications:

MoV1 Second Edition with 36pp (2 extra colour plates) is at the printers.
MoV4, Emeralds and Allies, is also at the printers with 180 species and the CD with 350 additional pages is being pressed.

3. Australian Entomological Society.

The Council of the AustEntSoc has prepared a new Constitution which will be put to a vote at the AGM in November. There will no longer be a category of Affiliated Society so we will lose our connection with the Australian

Entomological Society. In the Constitution which is being amended we were recognised as a Foundation Affiliated Society.

4. Associations Incorporation Reform Act 2012.

The new Act which regulates incorporated societies will become effective on 26 November 2012. We will have 12 months to review and amend our Constitution and Rules so that they conform to the new legislation. This will be a substantial task. Peter Marriott will ask Ian for a brief summary of things we need to address.

5. Bulletin price

Peter Carwardine investigated the possibility of selling the bulletin in shops. He found this would not be financially viable. After discussion it was decided that the price noted on the bulletin cover no longer covers the cost. It was suggested a change to $4.00, subject to approval at next meeting.

6. The Grampians Expedition is in progess with 5 VicEntSoc members participating.

Meeting was closed at 6:20.

Future Meetings

2013 meeting dates: Council meetings: March 19, May 21st, July 16th, Sept 17th, Nov 19th

Month	*Date*	*Planned event*	*Topic*
February	19th	General Meeting Speaker	Damselflies and Dragonflies
April	16th	AGM	Speaker TBC
June	18th	General Meeting	Members' short presentations
August	20th	Members' excursion	TBC
October	15th	General Meeting	Members' short presentations
December	12th TBC	Excursion	Usually earlier then the 3rd Tuesday to reduce conflict with holiday celebrations.

Corrigenda:

VE Vol.42 No.5 page 87 Caption box for figures "Other photos from Chris-Anne were...what we believe to be a leopard" Please add "Slug *Limax maximus.* Photos by Chris-Anne Pleasance." We apologise to Chris-Anne for making it appear she had sent us a mammal photo and for omitting her photo credits.

VE Vol.42 no.5 Butterflies of the Wingan Inlet area...page 104 paragraph 3 "A female has been recorded at Gipsy Point... "

Read: "Females have been recorded by the second author and D.F. Crosby (Dunn and Dunn database)."

The brown lacewing, *Micromus tasmaniae* in Tasmania: Part 2

LIONEL HILL Lionel.Hill@dpipwe.tas.gov.au.
Department of Primary Industries, Parks, Water & Environment, Tasmania, P.O. Box 303, Devonport 7310

This is the second part of an article that collates information about brown lacewing (BL), *Micromus tasmaniae* (Walker) (Neuroptera: Hemerobiidae) in Tasmania. The first part summarised historic data to clarify seasonal occurrence and breeding of BL in Tasmania. It also examined light trap data and related meteorology for 12 years to suggest that large catches may reflect the arrival of migrant BL rather than local dispersal of the resident population. In Part 2 the light trap data is further examined and data for 2004-05 is compared to field observations of BL in lettuce crops infested by the currant lettuce aphid, *Nasonovia ribisnigri* (Mosley), whose first appearance in Tasmania (and Australia) in 2004 was described in previous articles.

Two explanations of light trap catches in 2004-05

The light trap is described in Part 1. The peaks in Figure 1 may reflect local dispersal of a sequence of about four local generations because they roughly match simulated local generation intervals, which are likely to be longer than those for extrinsic sources of immigrants such as the mainland, as shown in Part 1.

Figures 2-3 indicate that seasonal trends in other years are less neatly explained as a sequence of local generations. Also, the four peak catches in Figure 1 near the G1-4 labels coincided with substantial immigration of other species as do most catches in the figure. For instance, G1 peak coincided with 268 migrant specimens in 13 species, G2 with 28 migrant specimens in 8 species, G3 with 59 migrant specimens in 12 species and G4 with 103 migrant specimens in 8 species. Only two catches in Figure 1, the first and last, represent BL trapped without putative or known migrants and vagrants. The second catch (27 Aug – 2 September) in Figure 1 occurred when a mass migration of pestiferous Noctuidae and diamondback moth was reported in Victoria (P. Ridland, pers. comm.) and the latter became suddenly numerous at Circular Head in far north-west Tasmania (J. Lynch, pers. comm.) although only two were trapped at Stony Rise along with three brown cutworm moths.

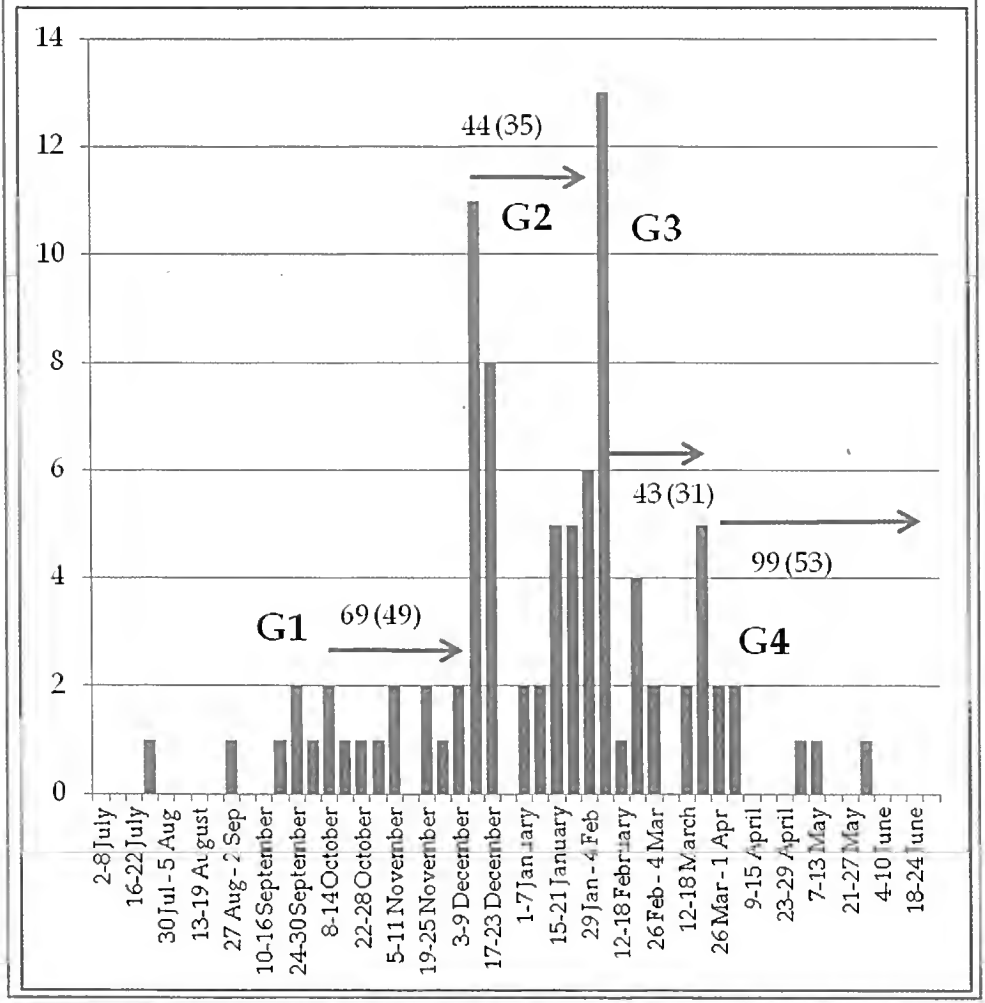
Duelli (2001) reported that the lacewing, *Chrysoperla plorabunda* adults undertook obligatory, preovipository and premating, downwind, migration flights for two nights after emergence during which they were not distracted by aphid honeydew. BL females take three days to mature (Yadav et al., 2009). Perhaps BL has preovipository dispersive behaviour in which immature females are more responsive to light traps than mature females. Of 231 individuals examined from the Stony Rise light trap, from a total of 1357 trapped, 71% were females.

In 2004-5 considerable sampling of lettuce crops (Hill *et al.*, 2006) for predators of currant lettuce aphid, including BL, was undertaken at Forthside farm, which is 10km west of the Stony Rise light trap and also about 5km south of Bass Strait. This enables field observations of adult and larval BL to be compared to light trap catches (Figs 1, 4, 5).

Relating 2004-05 light trap catches to lettuce populations of BL

The light trap catches for 2004-5 do not show a striking correlation with the abundance of adult BL in nine sequential and contiguous iceberg lettuce crops grown 10km to the west at Forthside (Fig. 4). Planting commenced 23 September 2004 and continued at 2-3 week intervals until 8 March 2005. First harvest occurred on 30 November, last on 10 May. Simulated BL generation durations were similar to or slightly less than crop durations. They were, with the respective BL generation duration in parentheses: P1 62 days (70), P2 68 (64), P3 55 (55), P4 57 (51), P5 48 (46), P6 62 (42), P7 62 (42), P8 63 (45) and P9 77 (58) with P indicating planting number. At any time there were about three contiguous plantings each with 5,500 lettuces.

Figure 1. Weekly catches of BL in Stony Rise light trap for 2004-05. G, generation; arrows indicate simulated generation durations in days for Forthside with respective values for Laverton, Victoria in parentheses.



For the first six plantings, 57% of plants were cultivars not resistant to lettuce aphid and not drenched with imidacloprid while 43% were resistant to the aphid. In the seventh planting 81% were undrenched and 19% drenched susceptible cultivars. The imidacloprid root-drench kills aphids for the life of the crop but also kills predators of poisoned aphids (Horne and Cole, 2005). In the last two plantings there were only 33% undrenched plants while 67% were drenched, (susceptible) cultivars. BL populations were estimated in three ways: vacuuming 84-100 immature, open plants at 2, 3 and 4 weeks after planting and visually inspecting 20-40 closed plants 1-2 weeks before and at harvest.

Adult populations of BL in young or old plants, when pooled, did not change greatly until the end

(Continued on page 119)

Figure 2. Weekly catches of BL in Stony Rise light trap by year with mean temperature for preceding winter, May-August (mean 9.4°C).

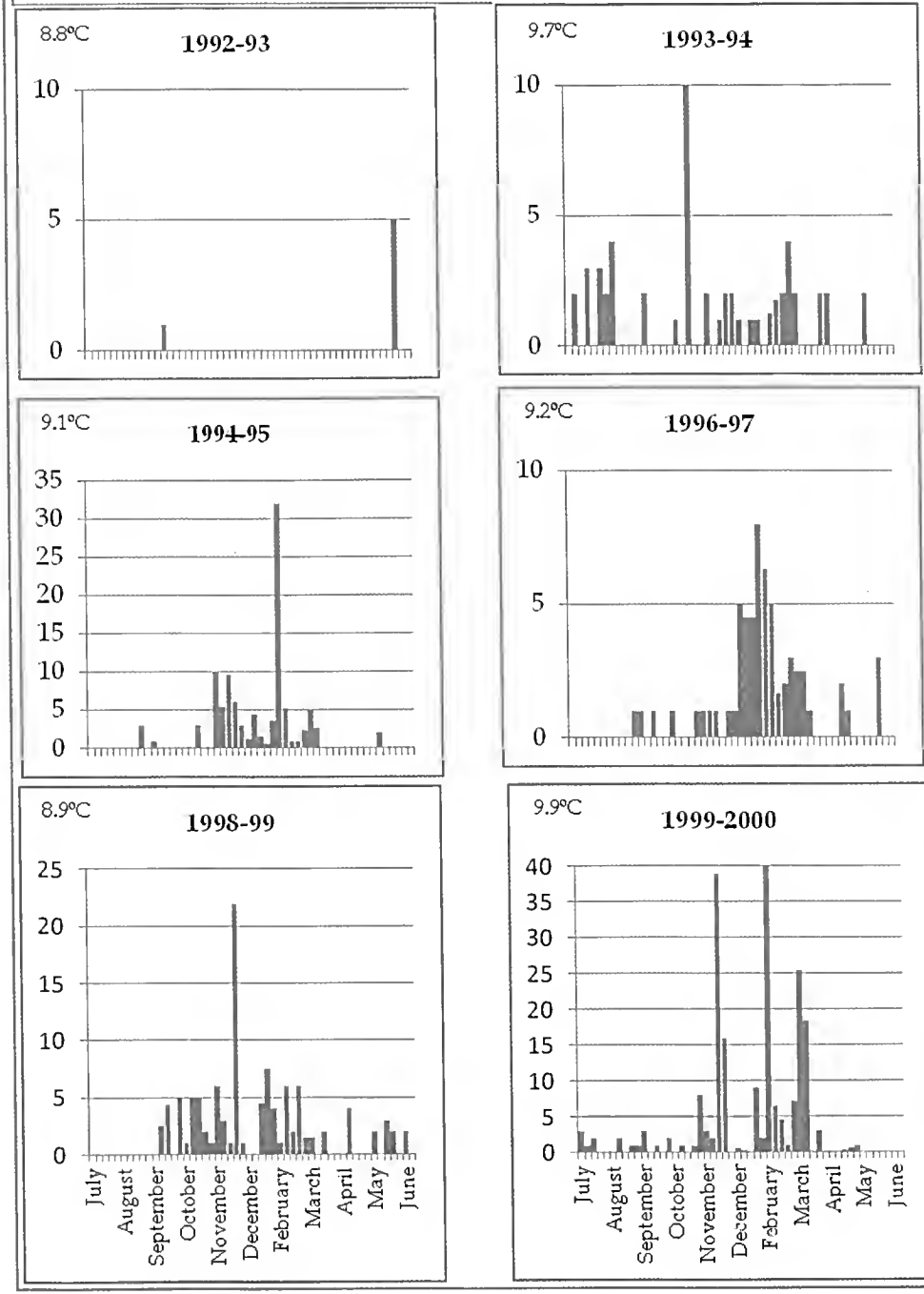
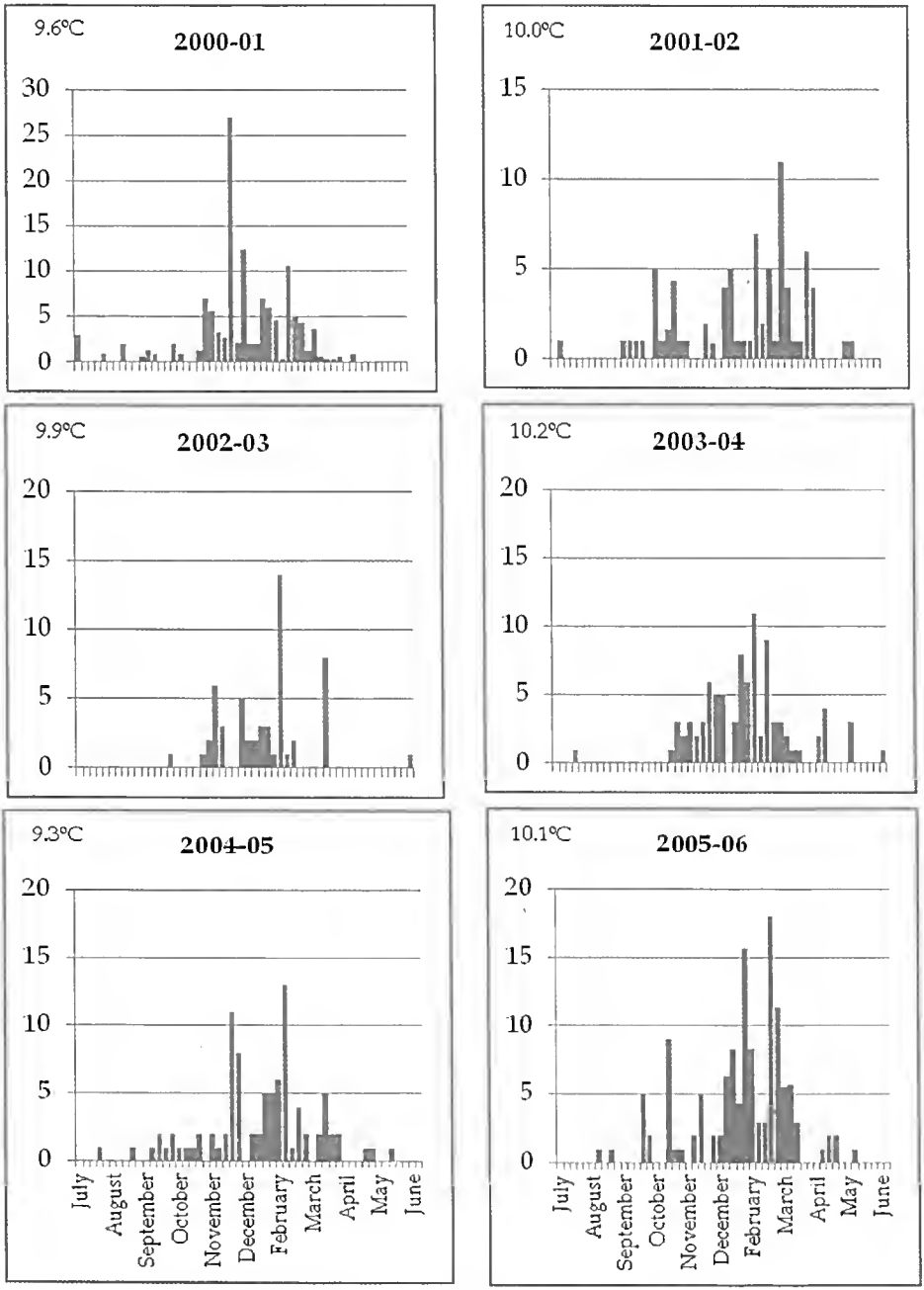


Figure 3. Weekly catches of BL in Stony Rise light trap by year with mean temperature for preceding winter, May-August (mean 9.4°C).



(Continued from page 116)

of February after the seventh planting had its final inspection (Fig. 4). Peak flight activity indicated by the light trap 10km away is not clearly reflected in the adult BL population in lettuce. The drop in BL numbers on immature plants in March may have resulted from the change to a high proportion of imidacloprid-drenched plants at the eight planting. This may have created a fatal sink for BL adults dispersing through the plantings (and perhaps for any related to the March light trap peak entering the crops from further afield). The eighth and ninth plantings yielded many adult BL near or at maturity, respectively, but these failed to control the aphids in the eighth planting and gave incomplete control in the last planting. Aphid numbers at the start of planting 8 were not particularly high or low but in hindsight the low population of adult BL foreshadowed loss of predatory control. In the seven previous plantings BL larvae and adults were instrumental in completely overwhelming the currant lettuce aphid populations whose pressure was sustained throughout the season.

At harvest, visual counts of BL larvae, probably biased towards the third instar, were highest in the first planting. This may reflect the time necessary for BL to disperse into the lettuce crops from elsewhere (Fig. 5). It may also reflect the relatively long BL generation time (70 days) relative to the crop (62 days). In later plantings, a greater proportion of the population appeared ready to disperse as adults by harvest time.

Figure 4. Weekly light trap catches of BL in 2004-05 with numbers of BL adults vacuumed from 85 open plants (2-4 weeks old) or seen in 20-40 closed lettuce plants (at 8 and 11 weeks old) in nine contiguous crops at Forthside, 2004 -05. Vacuum sampling dates are indicated by value 0.1 if zero BL were detected. Arrows are simulated generation durations. P, planting number.

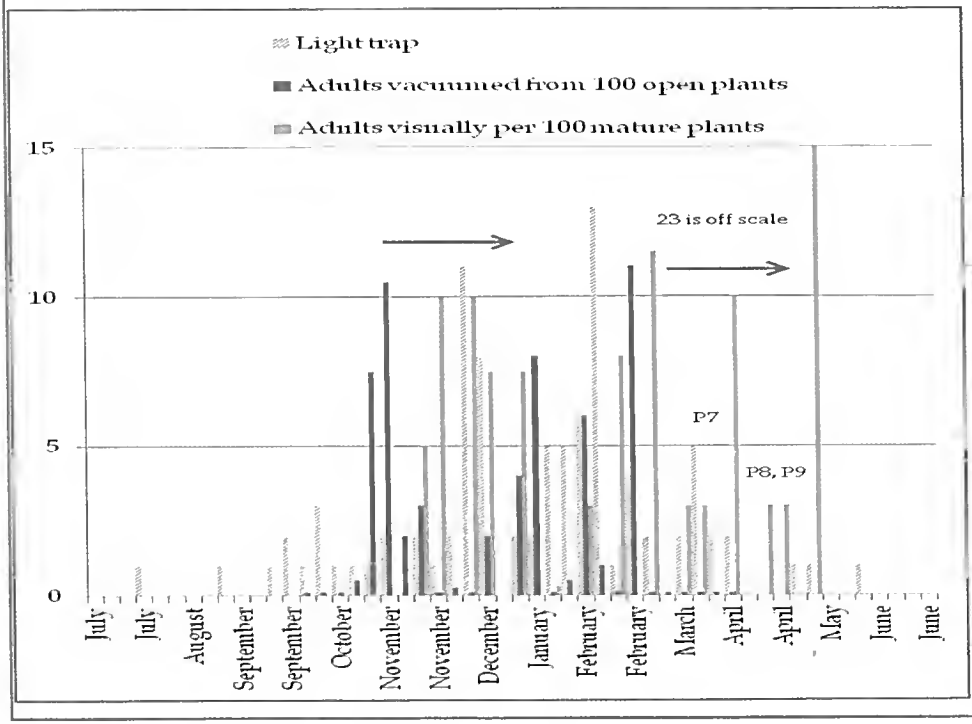
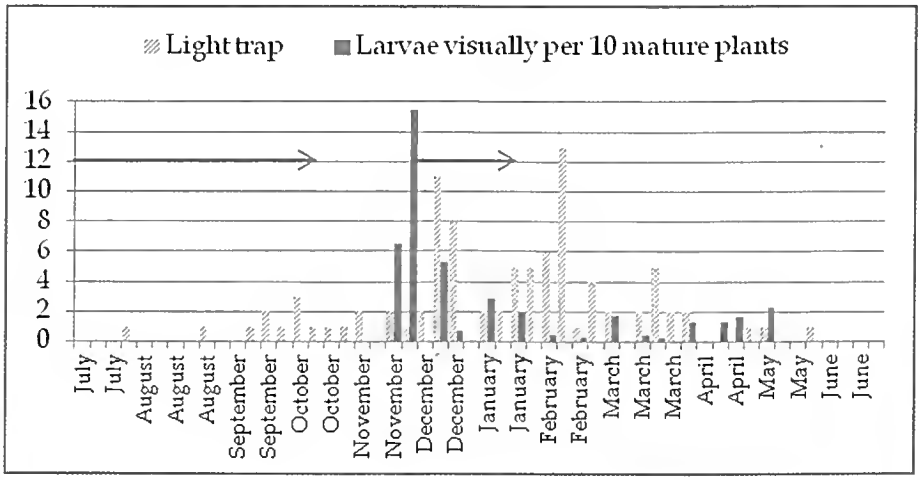


Figure 5. Weekly light trap catches as in Fig 1 compared to numbers of BL larvae seen in 20-40 mature lettuce plants as in Figure 4. Arrows are simulated generation durations.



Conclusion

BL is capable of strong local multiplication in Tasmanian crops sufficient to sustain integrated pest management. Light trap catches did not correlate conspicuously with populations in a lettuce crop 10km away and may not be relevant to integrated pest management decisions, which need to be based on direct observations of crops. Large light trap catches of BL coincide with the arrival of known migrants and warm airflows favourable for migration and do not follow a pattern indicative of the local dispersal of a succession of generations. Another notable and widespread predator, the Pacific damsel bug, *Nabis kinbergii* appears in light trap catches less frequently than BL but usually coincidentally with it.

References

Duelli, P. (2001). Lacewings in field crops. Pp 158-171 in *Lacewings in the crop environment*, Eds McEwen, P.K., New, T.R. and Whittington, A.E., Cambridge University Press.

Hill, L., McDougall, S. and Horne, P. (2006). Integrating lettuce aphid into IPM for lettuce: a commercial trial. Final report for VG04067, AusVeg.

Horne, P. A. and Cole, P.G. (2005). The impact of aphicide drenches on *Micromus tasmaniae* (Walker) (Neuroptera: Hemerobiidae) and the implications for pest control in lettuce crops. Report to AusVeg and Horticulture Australia Limited, 11pp.

Yadav, A., He, X.Z. and Wang, Q. (2009). Patterns of adult emergence and mating in *Micromus tasmaniae* (Walker). *New Zealand Plant Protection* 62: 179-183.

Observation

Amycterine weevil (Coleoptera: Curculionidae: Amycterinae) *Tetralophus* species feeding on Orchidaceae *Thelymitra* species at Langwarrin Flora and Fauna Reserve in Victoria.
Reported by Linda Rogan

I found this rather truncated weevil systematically working its way up the *Thelymitra* stalk and munching each bud along the way. Finding this unusual, I sent the photo to Rolf Oberprieler for possible ID and information.

His response appears, in part, below:

"Your pictures are very interesting and probably unique, as the association between *Thelymitra* orchids and this weevil – *Tetralophus* – has only come to light very recently. Nick Porch wrote a little paper in the Australian Entomologist on it in 2009

Porch, N. (2009): The first record of an amycterine weevil (Coleoptera: Curculionidae: Amycterinae) feeding on Orchidaceae. - *Australian Entomologist* 36 (1): 29–32.

All we know about the biology of this genus is in there (but no photos such as yours). The species in your picture is probably *T. sculpturatus* as well, but I can compare the other one to make sure.

The Amycterini are perhaps the most iconic of Australian weevils, the tribe being endemic here and including our largest weevils. The other genera develop on lilies, grasses and some other monocots, but none so far recorded from orchids." Rolf Oberprieler

Papilio demoleus L. (Lepidoptera) in Victoria, November 2010 to March 2011: southward migration and northerly return migration

Ian G. Faithfull[1] and Kelvyn L. Dunn[2]
[1] 2 Jacana Drive, Carrum Downs, Victoria, 3201; [2] kelvyn_dunn@yahoo.com

Abstract
Forty-two author sightings of *Papilio demoleus* Linnaeus (Lepidoptera: Papilionidae) in Victoria, Australia, are recorded for the period November 2010 to March 2011, during an historically unprecedented irruption of the species in the State. Details of flight directions and behaviour are reported. A series of observations, mainly at Knoxfield, an outer eastern suburb of Melbourne, indicate diffuse southerly migration from early to late November and then a reversal of direction to predominantly northern movement from late November through March, indicative of return migration. A few of the southern Victorian records, and two records obtained by other observers during the period, do not conform to this general pattern.

Introduction
Papilio demoleus, commonly known as the Chequered Swallowtail on account of its wing patterns, is a small papilionid butterfly with a broad range from west Asia to Australia and a core Australian distribution in the arid and semi-arid inland (Braby 2000). There appear to be two ecological strains or biotypes, which were once isolated geographically: the *Citrus* (Rutaceae)-feeding form in Asia, where it is a commercially important pest (Homziak and Homziak 2006); and the Australian and New Guinean populations which primarily feed on *Cullen* Medik. (Fabaceae), formerly included under *Psoralea* L. (Braby 2000). In Victoria, *P. demoleus* appears not to have been reported from *Citrus*, despite the presence of a commercial citrus industry and much availability of these plants in suburban and rural gardens across the State. However economic injury to citrus has been reported in New South Wales, at Gosford in occasional seasons (Hely 1968). Host selection and apparent variable tolerance of *Citrus* during larval development among Australian populations (see Braby 2000 and references therein) warrants further study. However the distinct host plant preferences and well -diverged mitochondrial lineages of the Asian and Australasian populations suggest that they may be separate species (Zakharov *et al.* 2004, cited in Eastwood *et al.* 2006; Braby 2010). This needs to be borne in mind in the study of migratory behaviour, as the stimulus for migratory events and the degree of migratory activity in Asia (*Citrus*-feeders) may well be different to that which occurs in the Australian region (*Cullen*-feeders).

Over its broader Indo-Australian range the species, as currently recognised, is a known migrant, but the establishment of populations on some islands reported in recent years may have been facilitated by human commerce, rather than the butterfly's own motive powers. For example, the species (represented by an Asian bio-type, namely subspecies *malayanus* Wallace *fide* Braby 2010) has been known from Christmas Island, Indian Ocean, since at least 1961, where there is only one natural member of Rutaceae and several introduced Citrus present (Moulds and Lachlan 1987). Some other islands closer to Australia were likely populated by natural dispersions in times past. In Western Australia the species occurs, about 55 km offshore, on Barrow Island (Smithers and Butler 1983) and, about 48 km offshore, on Bernier Island (Williams and Hall 1993), two noteworthy examples for the *Cullen*-feeder strain. Historically, populations were absent from islands of Indonesia (which occur in the intermediary region of the biotypes) until cultivation of *Citrus* (Matsumoto 2002) enabled expansion of the Asian strain (whether by human assistance, their natural dispersal ability or an admixture of both) eastward towards the Wallace Line. However accounts of lengthy dispersions and sea crossings without human assistance remain few, and it may be for this reason why the Wallace Line has not been breached. Interestingly, the *Citrus*-feeding biotype has recently established in the Caribbean, far from its Asian provenance, a range expansion to the New World that is almost certainly the result of human-transport (Eastwood *et al.* 2006, Homziak and Homziak 2006).

In the south east of mainland Australia (the focus region of this account) the butterfly is known to make sporadic mass-incursions into Victoria. Over the last 150 years there have been eight prominent southward expansions to central Victoria (where the butterfly is usually absent) (Dunn 2011), but none of them are known to have extended across Bass Strait to Tasmania. A similar event during 2010-11 in central Victoria was sufficiently large to recognise, for the first time, return northerly migration.

The occurrences of *P. demolens* in Victoria during 2010-11 were unprecedented in living memory and indeed historically. The experience of the first author (IGF) of the species in Victoria had previously been very limited: a single probable sighting at Fawkner Park, South Yarra about 1.30 pm on 27 March 1984 (a rapidly flying individual that disappeared to the west over a row of trees) and an old specimen collected in childhood in the Wangaratta region, about 1965. The second author (KLD) had previously seen the species on at least six occasions close to or in the greater Melbourne metropolitan region: one adult seen in about 1973 (during childhood), two or more in October and one in December 1977, and single encounters in September 2001 and November 2004. Several contributors to the *Victorian Entomologist* have recently reported observations in a broad band across central Victoria from November 2010 to mid February 2011 (Curle 2011 pp. 1, 4; Rogan 2011, Dunn 2011). Dunn (2011 p.55) reported a total of 36 'database records' of the species in Victoria, including one juvenile, from September 2010 to April 2011, a period that included numerous records of other unusual butterfly species in the State, but not as flight companions of *P. demolens*. A 'database record' (sensu Dunn 2011) comprised a unique locality, date combination such that multiple individuals seen on the same day at the same descriptive locality were counted as 1 'record'. The initial tally (of 36 database records) has since risen to 57, including the juvenile, and subsequently a bred adult. However a high proportion of the database records available from other observers are simply of presence, lacking information about flight direction or other behaviour. The authors' more detailed observations listed below (consisting of 42 presumed individual butterflies; equating to 24 unique day/locality records included in the tally of 57 above) indicate substantial migratory movement of *P. demolens* and evidence of return migration.

The only previous published record of population movement by this species in Victoria appears to be that of Fenselau (1977). He recorded approximately 45 *P. demolens* in the Sea Lake area of northwest Victoria over three days in late August 1977 "all flying in the same direction from north to south". In spring 1976 he had seen only two individuals, at Dimboola on 12 September and near Elmhurst in October.

Smithers (1978 p. 12) summarised seven known population movements and possible migrations of *P. demolens* in Australia (including Fenselau 1977) and noted that the species had "been confirmed as a strong migrant ... but comparatively little detail has been recorded." His conclusion was that the species "appears to undertake somewhat sporadic migrations, the evidence ... often being ... sudden appearance ... in areas in which it is not usually resident" (*op. cit.* p. 13). Smithers (1978) did not include the records of Lyell (1909), who wrote on 18 November 1908 that:

> "The appearance of the butterfly *Papilio sthenelus*, Macleay, in our State [Victoria] is so seldom noted that a recent capture seems worthy of record. Anderson and Spry record [*sic*] it from Bacchus Marsh, Melbourne and Moe, but their most recent date is 1890. I have not heard of its capture in recent years till this month it has been sent me by Mr. Frichot, of Dimboola, who took it on the wing on 8th November. Mr. G.A. Waterhouse, of Sydney, saw a specimen flying in the streets of Adelaide on 11th of this month, but it is known there as a rare visitor only. He tells me that he has only once seen it flying in Sydney, but several specimens have been captured there in recent years ..."

Dingle *et al.* (1999) examined published records of population movement of *P. demolens* and found only Smithers (1978), and articles cited therein, which provided too few examples to statistically

analyse seasonal changes in flight directions.

Dunn (2011 p. 56) detailed seven previous seasons or years with at least two database records of *P. demoleus* in "central" Victoria (36-39°S, 143-147°E, which includes much of both the north and south of the State): 1872-73 (3 records), 1917 (2), 1954-55 (3), 1968 (2), 1973-74 (15), 1976-77 (5) and 2001 (2). In comparison 49 unique date/descriptive locality (database) records for this defined region have now been accumulated for the 2010-11 season, eighteen more than reported by Dunn (2011 p. 56) and including all of the 24 author records detailed below. Dunn noted (*op. cit.* p. 56) that "Where food plants are available localised colonies can form in Victoria", on the basis of correspondence with one or more data suppliers who provided local life history information, in addition to sight records.

Most of the historical literature records of the species in Victoria have been made in published formal articles but occasional encounters have been documented *ad hoc* in Entomological Society of Victoria records. Examples include a mention in Minutes of the 18 June 1971 general meeting that "The Chequered Swallowtail Butterfly was taken in the Blackburn and Box Hill areas" (Anon. 1971). No dates were given for these records, which were excluded by Dunn (2011) because of (1) uncertainty about the year in which they occurred; (2) the absence of other 1971 records; and (3) unavailability of any actual specimens. In addition, there is a report of an afternoon observation along the road to Bacchus Marsh during a Society excursion to the Brisbane Ranges on 4 March 1973: a "highlight for the lepidopterists was the sighting ... of what was almost certainly a Chequered Swallowtail ... a rare visitor to southern Victoria" (Anon. 1973 p. 13). This record was included as part of Dunn's (2011) 1973-74 tally.

Accounts of migratory activity of this species outside Australia (pertaining to the Asian *Citrus*-feeding strain) are also available. For example, Williams (1930) detailed observations of migrations in India and Sri Lanka of large and small numbers, always with other species of butterflies, mainly Pieridae and Nymphalidae. The majority of records in south India were of southward flights in October and November, which is after the end of the rainy season (c. June to September in south India). Braby (2000) indicated the whole of mainland Australia as transient distribution of *P. demoleus*, giving no hint as to where source populations may boom or bust, or the source of migrant individuals. Companion species do not appear to be a feature of the Australian events that we have seen.

Observations

Details of the observations are provided in Table 1. Table 2 provides latitudes and longitudes of the localities at which observations were made. Most of the observations were opportunistic, but some were the result of deliberate attempts by the first author to quantify rates of population movement. These involved watching from a fixed point with a clear line of vision over a known distance at approximately right angles to the direction of movement of the butterflies. Such records enable rates of population movement (number/km/hr) to be estimated.

Almost all of the butterflies observed were flying strongly and travelling fast, 1-3 m above the ground, in a clear direction that was maintained while the butterflies remained in sight. None were observed at rest, but a single adult was seen foraging at Loch in South Gippsland. In all other observations except that at Rutherglen the movements observed were "undistracted by other factors" (e.g. nectar sources, specimens of the opposite sex), a defining characteristic of migrating butterflies according to Dingle *et al.* (1999 p. 324). In most cases the speed of flight was faster than a person can run and estimated by the first author to perhaps be in excess of 30 km/hour. At Knoxfield, one individual was observed to fly over a very large, two-storey storage shed without changing heading, and others flew over, rather than around tall obstacles, such as treelines, in their paths. We consider these directional flights consisted of butterflies in 'migratory mode' because constant directions were maintained despite obstacles, low and uniform altitudes were maintained unless obstacles intervened, the flight speeds were very rapid, and potential distracting factors appeared to have no influ-

ence on flight behaviour.

The most notable flight patterns of *P. demoleus* in the records are, with few exceptions, a uniform axis of movement for the Melbourne area records, either north to south in the earlier part of the season, or later south to north, and a clear reversal of direction of movement between 24 and 30 November at Knoxfield. Clear directional movements were observed almost always during the middle of the day (the latest at 16.10 h summer time), despite observations outside these times. In one deliberate count at Knoxfield, six individuals were observed crossing an 80m line in 30 minutes on 18 February, all flying north. This equates to 150 individuals per kilometre per hour.

In October 2011, after the migrations had dissipated in Victoria, the second author found that adults were common in central inland New South Wales, with the most southerly observation at Carrathool Bridge Reserve, east of Hay. All of these individuals were seemingly in non-migratory mode. No observations of the species are available for NSW during the period of the Victorian migrations except one report from Albury, in February 2011, of an adult feeding at *Lantana* sp. (prob. *L. camara*) (P. Seely and E. Collins; Dunn and Dunn database).

The spring of 2010 and the summer of 2010-11 were notable for extensive high rainfall in eastern Australia, with major flooding. Continued periods of high humidity were experienced in Victoria throughout the summer and there was substantial persistent flooding in various parts of the State.

Discussion

Two published records appear to contradict the general conclusions of migrational directionality during the period in question. Michael Braby (in Rogan 2011) reported one individual flying west on 8 January 2011 at 11:35 h at Eltham, and Frank Pierce (in Rogan 2011) saw two flying east on 15 February 2011 at Watsons Creek.

Two of the second author's observations are not consistent with the perceived general pattern: single individuals at Dandenong, 13.20 h, 14 February 2011 flying SSE, and Cardinia Reservoir at Duffy's Road Picnic Ground, 15.25 h, 17 February 2011, flying south. A further inconsistent observation was of an individual flying NW by W from Cheviot Hill lookout, Point Nepean National Park, on the southern coast of Victoria, towards Point Nepean at 15.20 h on 22 November 2010. On arrival at Cheviot Hill the individual patrolled the summit at 1 m altitude for 20-30 s (repeating a very narrow elliptical circuit two or possibly three times), and then flew rapidly along the direction of the coast towards the Point. It may have ceased southward flight at the coast and was then following the coastline rather than flying out into Bass Strait or was beginning a return migration.

The flight of this species when migrating, estimated by IGF as perhaps 30 km/hr, appears exceptionally fast. However the speed of flying insects "estimated by the eye without watches and measured distances can be very misleading" (Williams 1965 p. 107). An actual flying speed for migrating *P. demoleus* of variably between 35-40 km/hr has been recorded by the second author, by following an individual by car for c. 200m along a straight section of Stony Creek Road, Upper Beaconsfield, Victoria, on 29 September 2001. Dell (1977 p. 84) stated that migrating individuals of the species in Western Australia "maintained a near constant speed of from 6 to 7 m/sec", equivalent to 21.6-25.2 km/hr. Table 3 lists some records of the speed of flight of Australian and non-Australian butterflies. *Papilio demoleus* in migratory flight appears to be one of the fastest.

A few hours flying south even at 10 km hour would easily have delivered those butterflies observed in the Knoxfield area to the coastline at Bass Strait, a barrier they are evidently reluctant to cross, since the species has not been recorded from Tasmania (Braby 2000). Lionel Hill of the Tasmanian Department of Primary Industries, Parks, Water and Environment, an expert on the migration of moths from the mainland to Tasmania, has kindly informed the first author (in litt., June 2011) that he had heard of no observations of the species in that State during the period in question. *Papilio*

demoleus is not one of those Australian migratory species that reaches New Zealand (Gibbs 1980). However the species certainly does fly over water: in South Asia it was present in a "large flight" consisting mostly of other butterfly species "about five to six miles out at sea off the coast between Karachi and Bombay", in the Arabian Sea in October 1928 (Williams 1930 p. 50). Its presence on Lord Howe Island as a "non-resident" (Gibbs 1980) and on North West Island (c. 51 km NE of the Australian mainland at Cape Capricorn) in the southern Great Barrier Reef (Burwell *et al.* 2011) indicates that in the Australasian region oceanic crossings do occasionally occur. However, it does not occur farther east in the Pacific than Lord Howe Island, being unknown presently from the larger South Pacific islands where various other migratory species are historically well known, and has been reported only recently (2005) on New Ireland, Bismarck Archipelago (C.J. Muller, cited in Tennent 2006). This suggests that the species has not usually been an adventurous seafarer, or has not favoured an easterly direction during migrations in the Australia-Pacific region. Possibly the butterfly's behaviour changes when accompanied by large numbers of other migratory butterfly species, as in the Arabian Sea flight, or the differing Asian and Australian biotypes exhibit different behaviours.

If southward movement in Victoria occurred over a wide front in mid to late November and ceased at the coast, then diffuse return movement could have occurred in early December, or late November (as the record near Point Nepean suggests). Southward migration that is 'frustrated' by an imposing sea barrier like Bass Strait may alternatively give rise to a period of local non-migratory flight or migration in other directions. However the southward migration, which seemingly peaked in late spring, possibly continued into summer, which could mean that whilst some individuals were redirecting northwards, some late arrivals to the Melbourne area, perhaps having come from farther afield beyond Victoria, were still moving south. These conclusions may require reinterpretation if additional records for the season become available or a fuller picture emerges of the metapopulation dynamics at the time.

Why so many migrating individuals were recorded at the Knoxfield site in comparison with the total recorded elsewhere in southern Victoria is puzzling. The regular presence of an experienced observer, deliberately watching for the species, provides part of the explanation. Yet the second author doing likewise on Point Nepean for nearly 3.5 hours on one of the days of the Knoxfield event, saw but a single migrating adult. Perhaps also an element of 'topographical funnelling' was occurring through this and contiguous south-eastern suburbs: to the east the land rises, over a distance of 4-5 km, from c. 100 m elevation at Knoxfield to the Dandenong Ranges, with peaks over 500 m elevation. Higher concentrations of the butterfly may have occurred at Knoxfield if it avoids or circumnavigates the mountains when in migratory flight. Factors such as reduced temperatures at higher altitude might influence such deviations in direction, since migrating individuals observed at Knoxfield almost always flew over buildings and trees without changing direction. That higher altitude *per se* is not a deterrent to this species is evidenced, for example, by an observation of Barnard (1921) of an individual near Mt Donna Buang, Victoria, at an elevation of c. 610 m on 30 October 1921. In addition the contemporary record from Mt Tassie (Table 1) was at or above 770m suggesting adults may cross the Great Dividing Range in Gippsland.

The main food plants of the larvae in Australia are species of *Cullen*, and Fisher (1978) noted that in the north of South Australia *P. demoleus* is particularly common in those seasons in which abnormally heavy rainfall has stimulated the growth of these plants. Victorian *Cullen* species are annual or perennial herbs that appear to often flower in response to rain (Jeanes 1996 p. 681). Seven of the eight Victorian species are endangered in Victoria and the other is uncommon (Jeanes 1996). Native non-woody legumes are typically highly sensitive to rabbit and sheep grazing and were probably eliminated from or greatly reduced in many areas of Victoria early in the history of settlement. Scarlett and Parsons (1993) discussed examples from *Glycine* L. and *Swainsona* Salisb. Agricultural activities were implicated by Muir (1991) in the decline of *Cullen parvum* (F. Muell.) J.W. Grimes, who mentioned cattle grazing and rabbits as detrimental, while FFG SAC (1991) identified heavy grazing,

land clearance and cultivation as factors responsible for disappearance of *C. tenax* (Lindl.) J.W. Grimes. This suggests that *P. demoleus* could once have been more widely and commonly present in this State than the sporadic records in historical times suggest. Migratory movements into Victoria may once have been highly adaptive, enabling the species to seasonally exploit the shifting abundances of its food plants, driven by rainfall, in the southern parts of the mainland.

Ambrose (2000) noted that *P. demoleus* is "known from Mt Warrenheip, where its larval food plant Mountain Psoralea *Cullen adscendens* [*Psoralea adscendens* F. Muell. = *Cullen microcephalum* (Rchb. ex Kunze) J.W. Grimes, the most widespread species in Victoria] grows. It may frequent Mt Buninyong." Ambrose (2005) classed it as uncommon in the Ballarat region (which includes these two mountains) and questionably non-breeding, and gave a flight season for the region, based on literature and unpublished observations, of late October to March. But he erroneously used the whole-of-Australia flight season given by Braby (2000) (i.e. throughout the year), as applicable in Victoria, and misleadingly stated (*op. cit.* p. 31) that it is a "widespread and abundant migrant". "Small numbers of Chequered Swallowtails were discovered during the early 1990s, patrolling stands of ... *C. adscendens* on the summit of Mt Warrenheip ... they may breed there regularly or more likely re-establish at intervals via migrants" and progeny of the plants were later demonstrated to support full larval development (Ambrose loc. cit.).

Dingle *et al.* (1999 p. 327) discussed the paucity of 'return migration' records for Australian butterflies as a "biological conundrum" since migration into a population sink should result in strong selection against migration. In many cases it is probable, as they suggested, that return-migrations "usually pass unnoticed". Faithfull (2005) provided evidence that Caper Whites *Belenois java teutonia* (Fabricius) (Pieridae) return north after migratory influxes into Victoria. The data presented here for *P. demoleus* provides strong evidence that return migration, probably of the same long-lived adults, was a feature of its population movements in 2010-11, and may be a normal feature of the species' migratory behaviour.

Although we are unaware of any population irruptions of *P. demoleus* in its core inland range in the period preceding or during the major Victorian influx/irruption, the flowering of the inland resulting from widespread substantial rainfall and flooding in that period may well have provided ideal conditions for its proliferation. Thus population pressures might have arisen that resulted in migratory activity. The exceptionally wet summer in Victoria in turn probably favoured the butterfly's food plants (e.g. several of the remnant populations of Victorian *C. parvum* are on irregularly flooded sites according to Muir 1991), perhaps enabling *P. demoleus* to temporarily expand its breeding range in this State.

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Table 1. Field observations: numbers and flight directions of *P. demoleus* in Victoria, November 2010 to March 2011, in chronological order. Dates are in the form dd/mm. Times are daylight saving (summer) time. Details of locations are provided in Table 2. 'Notes' often record the altitude of flight, then the distance of flight-travel observed (e.g. seen flying "over 25 m") and other pertinent factors, including annotation if the species was uncertainly identified. Defined observation periods when butterflies were particularly watched for but no *P. demoleus* were seen are also detailed.

Date	Time (DST)	Location	N	Direction	Observer	Notes
9/11	13.11	Knoxfield	1	S	IGF	probable; 2 m altitude
21/11	16.10	Doveton	1	SSW	KLD	2 m altitude, flying rapidly; S wind, sunny c. 19°C; 5 minutes observation time at site
22/11	11.32	Knoxfield	1	S	IGF	2-5 m altitude, flew over buildings; light-moderate NW breeze
22/11	11.39-11.48	Knoxfield	0	-	IGF	100 m observation line
22/11	15.20	Cheviot Hill	1	NW by W	KLD	sunny, c. 28°C, still, but ESE breeze much of day; 3h 25m (1430-1755h) total observation time in Park
23/11	11.08-11.18	Knoxfield	1	SSE	IGF	11.08, rapidly over 4 m building, over 10 m; gusty light-moderate N-NNW wind, sunny, c. 28°C
23/11	13.24	Knoxfield	1	SSW	IGF	over 25 m
23/11	13.37-13.45	Knoxfield	0	-	IGF	c. 100 m observation line
23/11	13.57	Knoxfield	1	S	IGF	?species - c.100 m distant
23/11	14.02-14.07	Knoxfield	1	SW	IGF	14.02, 2-3 m altitude, flew over shade house, over 40 m; 100 m obs line; 25% cloud, gusty light-moderate NW wind, c. 30°C
23/11	15.33-15.40	Knoxfield	0	-	IGF	
23/11	17.45-17.50	Knoxfield	0	-	IGF	
24/11	10.43-10.53	Knoxfield	0	-	IGF	100 m obs line; 60% cloud, c 28°C, gusty NW moderate-strong wind
24/11	13.05-13.17	Knoxfield	0	-	IGF	30 m obs line; 100% cloud, c 27°C, cool N to NW moderate-strong wind
24/11	15.45-16.02	Knoxfield	2	SE	IGF	15.54 v. fast, flew over building, over 5 m; 15.56 over 15 m; NW wind, 100% cloud, humid
30/11	13.27	Knoxfield	1	NNW	IGF	very fast, flew over 7 m high shed; c 30% cloud, light-moderate SE wind, c. 25°C
30/11	13.39	Knoxfield	1	NW	IGF	?species; over 5 m
30/11	13.44-14.00	Knoxfield	0		IGF	80 m observation line
6/12	13.35	Frankston	1	NE	IGF	2-4 m alt., over 25 m; mod. gusty NW wind
27/1	14.10-14.30	Loch	1	-	KLD	feeding at *Buddleia* flowers, worn and chipped; collected; sunny 24°C;
2/2	14.05-14.50	Rye	1	-	KLD	road killed perhaps 10-20 minutes earlier, specimen collected (very worn adult)
2/2	13.04	Carrum Downs	1	E or SE	IGF	across footpath into garden, over c. 3 m
10/2	13.51	Knoxfield	1	NNE	IGF	2-4 m altitude, over 25 m
14/2	13.20	Dandenong	1	SSE	KLD	flew rapidly across road junction; c. 1m altitude; sunny 21°C

Table continued next page

Table 1 (continued).

Date	Time	Location	N	Direction	Observer	Notes
14/2	13.42	Knoxfield	1	WNW	IGF	very fresh looking, NW for 10 m, W for 15 m along road past 6 m tall shed, then NW for 5 m; 1-3 m altitude
14/2	13.55	Knoxfield	1	W	IGF	?species, over 100 m
14/2	14.01	Knoxfield	1	N	IGF	over 5 m
14/2	14.02	Knoxfield	1	N	IGF	fresh looking, 1-2 m, over 25 m
14/2	16.02	Knoxfield	1	W	IGF	c 3 m over top of Insect Taxonomy Lab
14/2	13.38	Knoxfield	1	NNE	IGF	rather pale, dull; flew over 6 m tall shed from 3-4 m altitude; near cloudless, warm, no wind
15/2	11.08	Knoxfield	1	N	IGF	10% cloud, c. 25°C, still/light air
15/2	12.22	Knoxfield	1	N	IGF	2-5 m altitude, over 30 m
15/2	12.59-13.29	Knoxfield	6	N	IGF	80 m obs. line; 13.08 N, 2 m alt., over 15 m; 13.10 N, c. 2 m, over 15 m; 13.17 N, 1 m, over 10 m; 13.18 N, 2-3 m, over 10 m; 12.19 NNE, 1-3 m, over 35 m; 13.27 N, 1-2 m, over 20 m
15/2	15.20	Mt Tassie	1	NNW	KLD	flying rapidly, c. 1-2m altitude; sunny
17/2	15.25	Cardinia Reservoir	1	S	KLD	Flying rapidly, c. 1-2m altitude; sunny period c. 25°C
17/2	13.45	Rutherglen	1	-	IGF	S for 5 m, E for 20 m, not migrating; hilltop "Arboretum"
18/2	12.22-12.24	Swanpool	2	NW	IGF	both over 40-50 m; humid, c. 25°C, 50% cloud, no wind
18/2	12.53	Lima South	1	NW	IGF	from moving vehicle
18/2	13.03	Maindample	1	?S	IGF	from moving vehicle
18/2	13.40	Yea	1	NW	IGF	from moving vehicle
7/3	12.55	Traralgon	1	E by N	KLD	from moving vehicle; c. 1-2 m altitude; almost certainly this sp. Sunny, c. 25°C
15/3	13.44	Knoxfield	1	NNW	IGF	rapid direct flight, 1 m altitude, over c. 30 m

Table 2. Locality and geographical coordinates of observation sites.

Date	Time	Location	N	Direction	Observer	Notes
14/2	13.42	Knoxfield	1	WNW	IGF	very fresh looking, NW for 10 m, W for 15 m along road past 6 m tall shed, then NW for 5 m; 1-3 m altitude
14/2	13.55	Knoxfield	1	W	IGF	?species, over 100 m
14/2	14.01	Knoxfield	1	N	IGF	over 5 m
14/2	14.02	Knoxfield	1	N	IGF	fresh looking, 1-2 m, over 25 m
14/2	16.02	Knoxfield	1	W	IGF	c 3 m over top of Insect Taxonomy Lab
14/2	13.38	Knoxfield	1	NNE	IGF	rather pale, dull; flew over 6 m tall shed from 3-4 m altitude; near cloudless, warm, no wind
15/2	11.08	Knoxfield	1	N	IGF	10% cloud, c. 25°C, still/light air
15/2	12.22	Knoxfield	1	N	IGF	2-5 m altitude, over 30 m
15/2	12.59-13.29	Knoxfield	6	N	IGF	80 m obs. line; 13.08 N, 2 m alt., over 15 m; 13.10 N, c. 2 m, over 15 m; 13.17 N, 1 m, over 10 m; 13.18 N, 2-3 m, over 10 m; 12.19 NNE, 1-3 m, over 35 m; 13.27 N, 1-2 m, over 20 m
15/2	15.20	Mt Tassie	1	NNW	KLD	flying rapidly, c. 1-2m altitude; sunny
17/2	15.25	Cardinia Reservoir	1	S	KLD	Flying rapidly, c. 1-2m altitude; sunny period c.25°C
17/2	13.45	Rutherglen	1	-	IGF	S for 5 m, E for 20 m, not migrating; hilltop "Arboretum"
18/2	12.22-12.24	Swanpool	2	NW	IGF	both over 40-50 m; humid, c. 25°C, 50% cloud, no wind
18/2	12.53	Lima South	1	NW	IGF	from moving vehicle
18/2	13.03	Maindample	1	?S	IGF	from moving vehicle
18/2	13.40	Yea	1	NW	IGF	from moving vehicle
7/3	12.55	Traralgon	1	E by N	KLD	from moving vehicle; c. 1-2 m altitude; almost certainly this sp. Sunny, c. 25°C
15/3	13.44	Knoxfield	1	NNW	IGF	rapid direct flight, 1 m altitude, over c. 30 m

Table 3. Some documented flight speeds of Australian and non-Australian butterflies arranged sequentially from highest to lowest speeds. A number of species are listed more than once. In some cases authors state that speeds have been estimated (E) and/or measured (M). Four previously unpublished records by the second author are included (see table footnotes).

Species	Family	Speed (km/h)	E/M	Notes	Source
Augiades crinisus (Cramer)	Hesp	48-97			Williams 1930
Badamia exclamationis (Fab.)	Hesp	40-48	E	migrating	Dodd 1933
Papilio demoleus L.	Pap	35-40	M	migrating	KLD[1]
Danaus plexippus L.	Nym	nearly 32			Williams 1930
Danaus plexippus L.	Nym	30-40	M	migrating	Smart 1975
Catopsilia pomona (Fab.)	Pier	30-35	M		KLD[2]
Graphium eurypylus L.	Pap	25		migrating	Braby 2000
Papilio demoleus L.	Pap	22-25		migrating	Dell 1977
Catopsilia florella (Fab.)	Pier	19-26	M		Williams 1965
Catopsilia florella (Fab.)	Pier	16-40			Williams 1930
Aphrissa statira Cramer	Pier	19	E/M		Williams 1965
Andronymus neander Plotz	Hesp	19	M		Williams 1930
Aphrissa statira Cramer	Pier	16-27.4	M		Williams 1930
Vanessa cardui L.	Nym	18-29	E/M		Williams 1930
Junonia villida (Fab.)	Nym	18	M		KLD[2]
Belenois sp.	Pier	16-24			Williams 1930
Danaus plexippus L.	Nym	15	M		KLD[3]
Vanessa atalanta L.	Nym	14	M		Lane 1947
Iphiclides podalirius (L.)	Pap	12	M		Lane 1947
Andronymus neander Plotz	Hesp	11-18.5	M		Williams 1965
Aporia crataegi L.	Pier	10-16			Williams 1930
Belenois aurota (Fab.)	Pier	10-13			Williams 1930
Appias drusilla (Cramer)	Pier	10-13			Williams 1930
Belenois (Glyœsthia) spp.	Pier	10-13	M		Williams 1965
Ascia monuste L.	Pier	10-13			Williams 1930
Belenois creona (Stoll)	Pier	10.5	M		Williams 1930
Belenois java (L.)	Pier	10	E	migrating	Dunn 1990
Vanessa cardui L.	Nym	10	M		Lane 1947
Marpesia chiron (Fab.)	Nym	about 10			Williams 1930
Pieris brassicae L.	Pier	9	M		Lane 1947
Ascia monuste L.	Pier	8-20			Smart 1975
Vanessa cardui L.	Nym	8-15			Smart 1975
Phoebis sennae (Cramer)	Pier	8-14.5	E/M		Williams 1930
Eurema senegalensis (Boisd.)	Pier	8			Williams 1930
Libytheana carinenta (Kirtl.)	Nym	7-24			Williams 1930
Anteos maerula (Fab.)	Pier	6-11			Williams 1930
Catopsilia spp.	Pier	0.8-19			Williams 1930

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compiled by Linda Rogan

CONTRIBUTIONS TO THE *VICTORIAN ENTOMOLOGIST*

The Society welcomes contributions of articles, papers or notes pertaining to any aspect of entomology for publication in this Bulletin. Contributions are not restricted to members but are invited from all who have an interest. Material submitted should be responsible and original. The Editor reserves the right to have articles refereed. Statements and opinions expressed are the responsibility of the respective authors and do not necessarily reflect the policies of the Society.

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CONTENTS

DIARY OF COMING EVENTS 2013

Tuesday February 19th 2013
Note 7:45 pm start
Nature Photographer: Reiner Richter
Victoria's Dragonflies and Damselflies in focus

Tuesday 16th April
AGM and speaker

Council Meeting
Tuesday 19th March

Scientific names contained in this document are *not* intended for permanent scientific record, and are not published for the purposes of nomenclature within the meaning of the *International Code of Zoological Nomenclature*, Article 8(b). Contributions may be refereed, and authors alone are responsible for the views expressed.

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